Space Weather Technical Forecast

Issued on Friday, 03 February 2023 at 01:09 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: Slight chance of M-flares. Slight chance of G1 Minor Storm on days 3 and 4 (05-06 Feb) due to arrival of a high speed stream from a coronal hole.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Activity has been Low, with only minor C-class flares in the past 24 hours. There are currently five sunspot regions on the disc. The largest and most notable is AR3207 Dsi/Beta in the southeast, although appears to be magnetically simple, this region has shown some slow growth. All other remaining sunspot regions are small, simple or in decay. A CME was observed off the northwest limb, which was associated with a filament eruption, which has been analysed and results show this is a clear miss. No Earth-directed CMEs have been observed on available imagery.

Solar Wind / Geomagnetic Activity: Solar wind parameters are indicative of a waning High Speed Stream (HSS) from CH73/-. Solar wind parameters are indicative of a waning High Speed Stream (HSS) from CH73/-. Wind speeds, as observed by ACE and DSCOVR at L1 were mostly steady and slightly elevated, near 420km/s, with a declining trend towards slow-ambient levels, as current HSS wanes. Density has been average to below average throughout. The total IMF strength, Bt, was weak, between 4-7nT, with the important north-south component (Bz) also weak, between +5/-4 nT. The Phi angle remained negative (towards the Sun) throughout. Geomagnetic activity was mostly Quiet (0-2Kp), with an Unsettled interval (Kp3) between 02/0000-0300 UTC.

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV) as measured at GOES-16 has been at background levels throughout. High energy electron flux (greater than 2MeV) measured by GOES-16 was at background to moderate levels. The associated 24 hour electron fluence declined to 1.46e6 integrated pfu by 03/0000 UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Low activity is forecast with the sunspots on the visible disc currently small and relatively simple. There is a very slight chance of M-class flares.

Solar Wind / Geomagnetic Activity: There are no Earth-directed CMEs, although a slight glance cannot be ruled out from a CME later on day 1 (3rd), although this will likely miss. Solar winds will continue to ease through the period, after the recent HSS from CH73/-, before the next CIR arrival ahead of CH74, which is likely later on day 2 (04 Feb) or more likely on day 3 (05 Feb) and lasting into day 4 (06 Feb). Geomagnetic activity is expected to be mainly Quiet to Unsettled with a slight chance of Active intervals. There is a slight chance of G1/Minor Storms, mainly day 3 (05 Feb) and possibly into day 4 (06 Feb) due to the arrival of HSS from CH74.

Energetic Particles / Solar Radiation: The high energy (greater than 10 MeV) proton flux observed by GOES-16 is expected to remain at background levels. Electron flux is expected to

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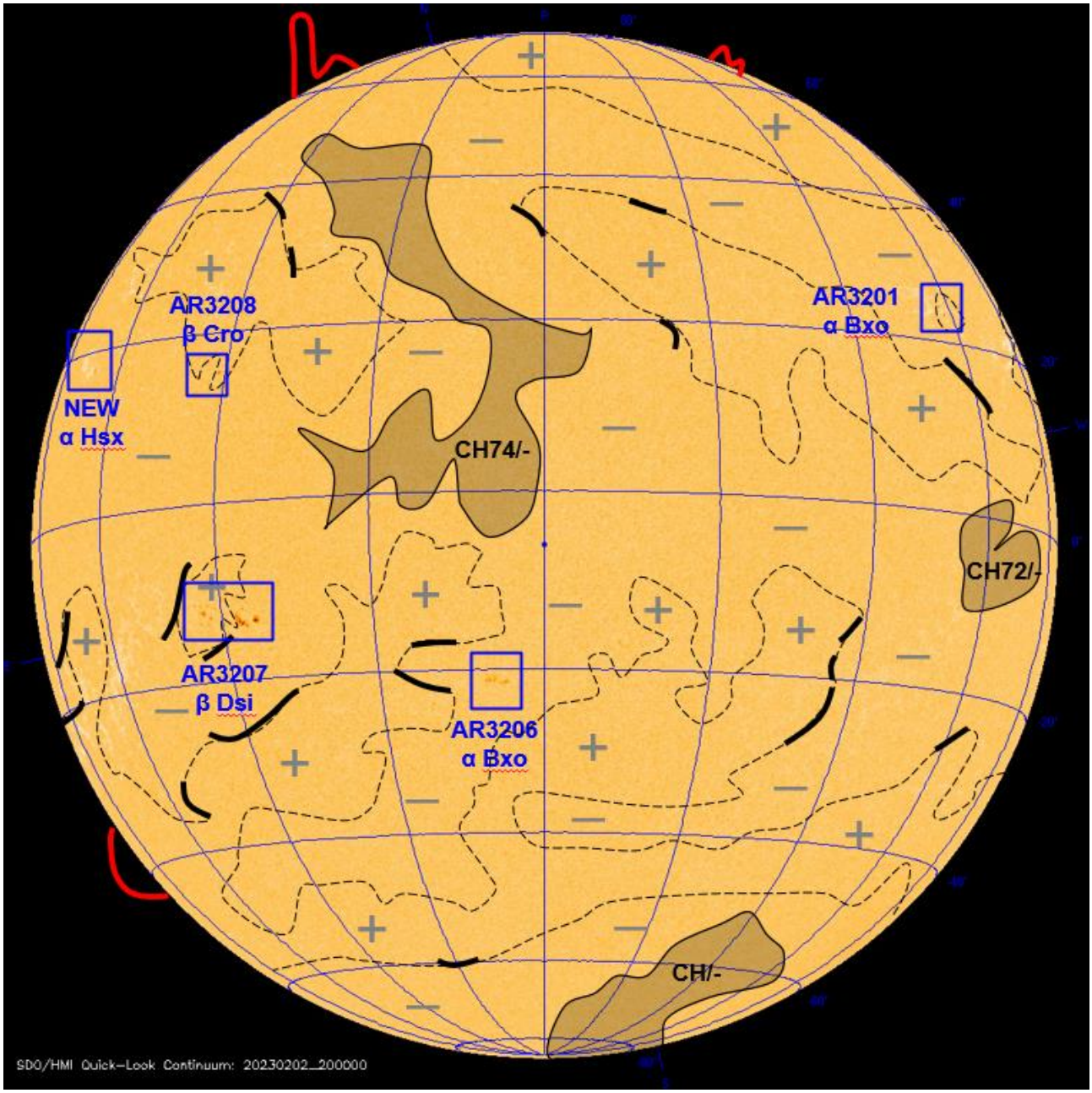
be at background or moderate levels. Electron fluence is expected to remain below the Active (1e8 integrated pfu) threshold.

Figure 1. Solar Analysis Valid 02/2000 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

There are no Earth-directed CMEs, however a CME that is expected to pass north and ahead of Earth may glance later on the 3rd Feb. However, confidence is very low with the analysis of this feature.

Enlil winds indicate a potential further enhancement on 3rd, but is likely due to an over-estimation of the size of CH74 in the east, with the following enhancement indicated in the model not expected until the end of the period, later on 4th or more likely on the 5th.

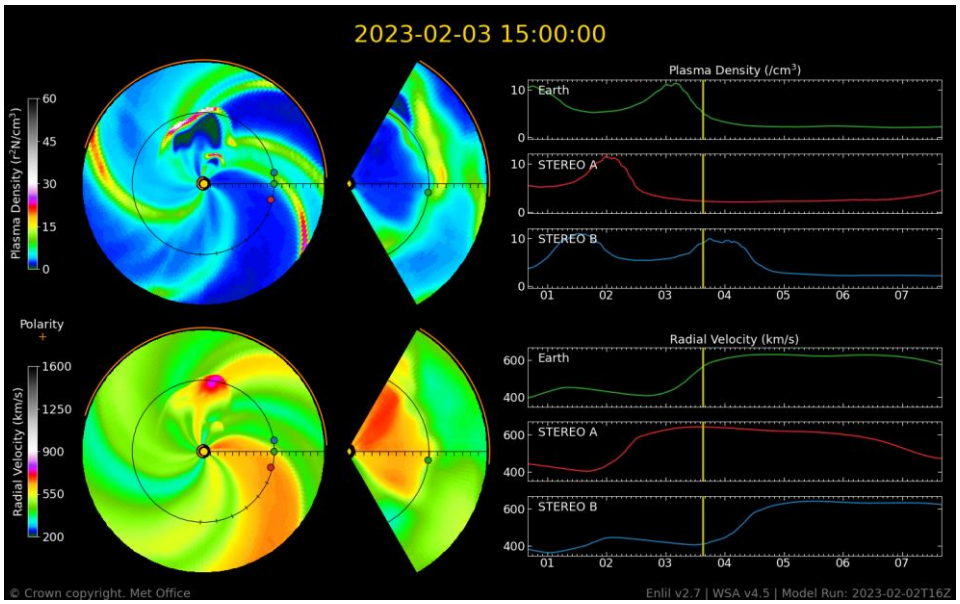
Geomagnetic activity is expected to be mainly Quiet to Unsettled throughout, with a chance of Active intervals. On day 1 and day 2 (3rd or 4th) there is the potential for a glancing blow from a CME (low confidence) before any CIR arrival is likely to occur ahead of CH74 HSS later on day 2 or into day 3 (4th or 5th), with rhe effects lasting into day 4 (6th). Slight chance of a G1 Minor/Storm on from day (4th) most likely due to the arrival of the next CIR/HSS from CH74.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	5	10	20	20
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

No Earth-directed CMEs have been observed in the past 24 hours.

Figure 2: MOSWOC Enlil – shows the arrival of CIR/HSS from CH74 on the 3rd Feb.



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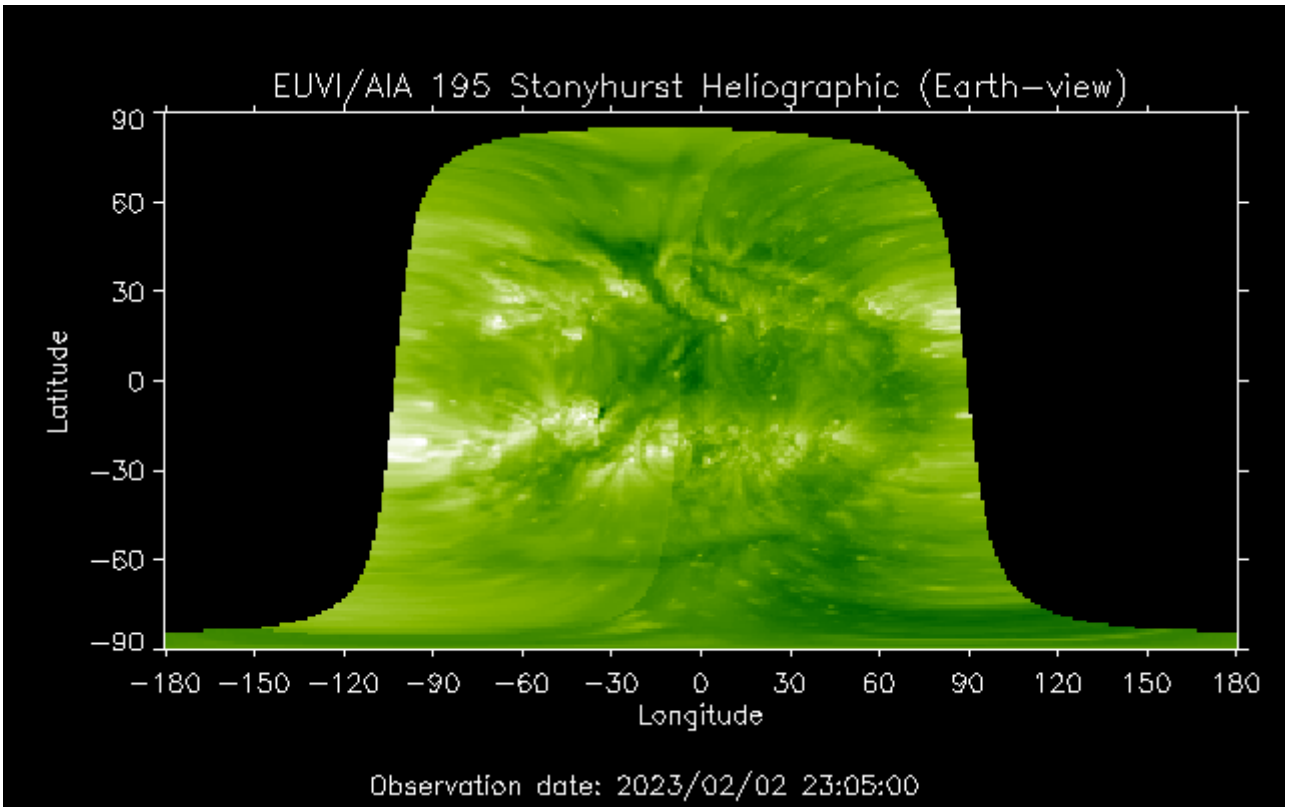
Radio Blackouts - X-Ray Flares:
There are five sunspot regions on the visible disc, however these are all small and magnetically simple. The most notable region is AR3207 in the southeast, and has been showing some slow growth in the past 24 hours. Activity is expected to remain Low with only a slight chance of increasing to Moderate with any M-flares that occur.

STEREO A euvi imagery shows the expected return of ex-AR3193 and ex-AR3184, potentially rotating onto the southeast within the next day or so. This is supported by helioseismic data, which shows the potential for further regions to rotate onto the disc through the period.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	10	10	10	10
Very Active	R3 to R5 X Class	No	1	1	1	1

Figure 3: STEREO-A 195 imagery show bright flux regions approaching the east limb.



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Solar Radiation Storms - (High Energy Protons):

High energy (greater than 10MeV) proton flux as observed by GOES16 is currently expected to persist at background levels.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	1	1	1	1
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

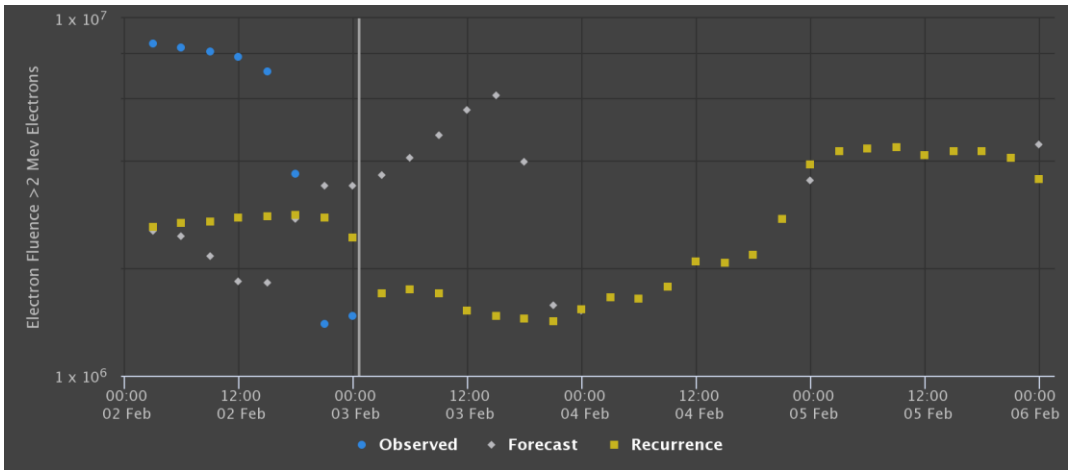
High Energy Electrons Event (≥ 2MeV):

High energy electron flux (greater than 2MeV) as observed by GOES-16 is expected to oscillate between moderate and background levels through the next four days, with only a very slight chance of rising to high on day 1 and day 2 (3rd and 4th) as solar winds ease after recent HSS. Although any periods of geomagnetic activity may act to suppress these values further.

Electron fluence is at low levels with any rise over the next four days expected to be modest, and remaining below the Active (1e8 integrated pfu) threshold. This is supported by REFM, although this is of limited value as this has yet to account for current solar wind enhancement.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	10	10	5	5
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

Figure 4: REFM electron fluence



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